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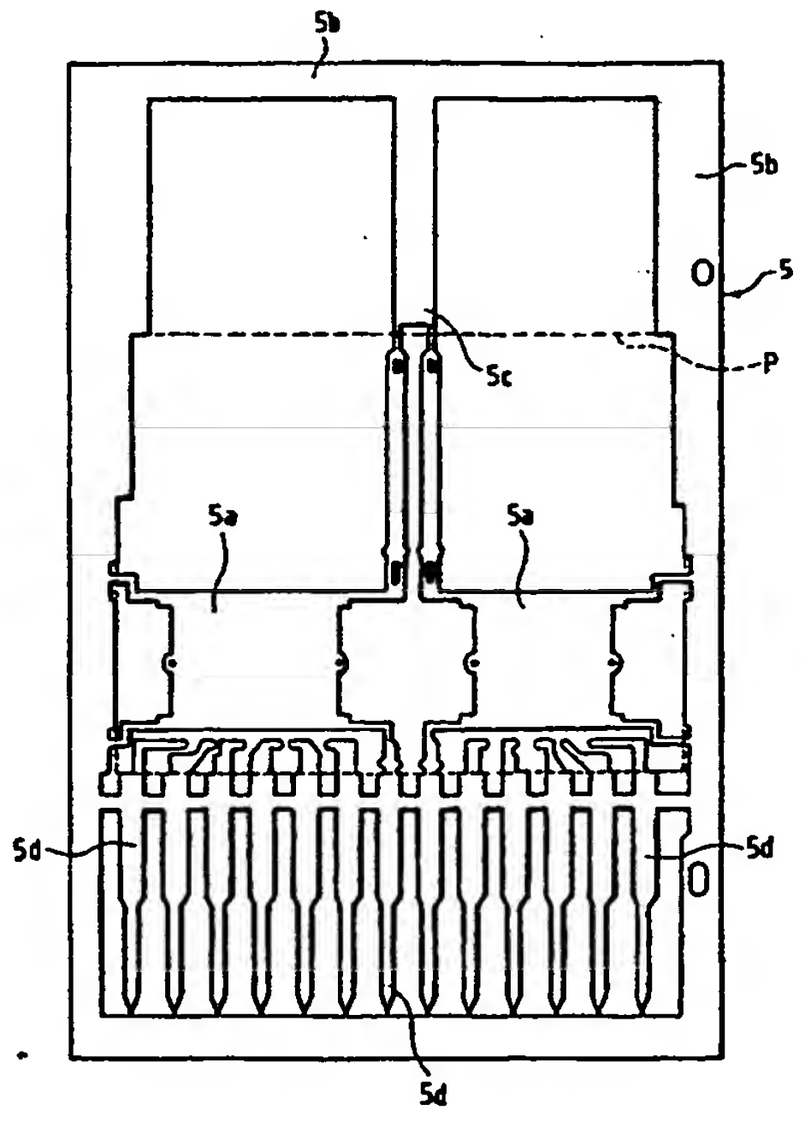
(54) Lead frame for semiconductor device.

(57) A lead frame (5), used for constructing a multi-core optical module or the like, includes a frame portion (5B), a plurality of a substrate portions (5A) on which electronic circuit elements are to be mounted, and a support portion (5C) for supporting the plurality of substrate portions (5A) to the frame portion (5B). The support portion (5C) has a plurality of separated end portions connected to the respective substrate portions (5A) at the position where a molded resin member (P) is covered, and at least two of the plurality of end portions are combined into one body to be connected to the frame portion (5B) at the position where the molded resin member (P) is not covered.

FIG. 3



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BACKGROUND OF THE INVENTION

The present invention relates to a lead frame used, for example, as a component for producing a multi-core optical module.

A multi-core optical module, in which a plurality of optical operation elements (laser-diodes, photo diodes, etc.) are linked to a number of optical fibers, is used for building an optical communication system such as an optical local area network (LAN).

To produce such a multi-core optical module, electronic circuit elements are mounted on a substrate portion 1a of a lead frame (Fig. 1 or 2) and optical connectors fixing optical operation elements are connected to the substrate portion through wires. Subsequently, the lead frame is attached to a mold die, after which the multi-core optical module is produced by filling the mold die with resin.

However, when the optical operation elements including optical transmission circuits and optical receiving circuits are mounted on the single substrate portion 1a of the conventional lead fram 1 as shown in Fig. 1, signals of the optical transmission circuits may flow into the optical receiving circuits (cross talk) since they have a common ground, so that erroneous operations are apt to occur. Further, the substrate portion 1a has an unnecessarily large area, so that a thermal stress at and after the molding step may cause deterioration by cracks generated in a formed resin portion.

On the other hand, when the substrate portion 1a is divided into two parts as in the conventional lead frame 1 as shown in Fig. 2, each being supported by three portions to electrically insulate the circuits, the substrate portion 1a is apt to move before the molding step, so that wires connecting the optical operation element to the substrate portion 1a are apt to be damaged. Further, the substrate portion 1a is apt to vibrate due to an ultrasonic applied at the wire bonding, so that it is difficult to assure a sufficient strength of wire bonding.

SUMMARY OF THE INVENTION

Therefore, an object of the present invention is to provide a lead frame in which a plurality of substrate portions are sufficiently fixed and are sufficiently insulated from each other in a final product.

This object is accomplished by providing a lead frame including a frame portion, a plurality of substrate portions on which electronic circuit elements are to be mounted, and a support portion for supporting the plurality of substrate portions to the frame portion, the support portion having a plurality of separated end portions connected to the respective substrate portions at the position where a molded resin member is covered, and at least two of the plurality of end portions being combined into one body to be connected to the frame portion at the position where the molded resin member is not covered.

According to the lead frame of the present invention, since the respective substrate portions are connected to the support portion, the substrate portions are sufficiently fixed to the frame portion. Further, since the support portion has the separated end portions at the position where the molded resin member is covered, the plurality of substrate portions are insulated from each other by cutting the end portions after resin molding.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGs. 1 and 2 illustrate lead frames of prior art;
FIG. 3 shows the first embodiment of a lead frame according to the present invention; and
FIGs. 4 to 7 show lead frams according to the second, third, fourth and fifth embodiments of the present invention, respectively.

DETAILED DESCRIPTION OF THE INVENTION

Preferred embodiments of the present invention will be described with reference to the accompanying drawings.

Fig. 3 shows a lead frame according to a first embodiment of the present invention. In Fig. 3, a lead frame 5 includes a support portion 5c disposed between a frame portion 5b and substrate portions 5a, and lead pins 5d. The lead frame is attached to a mold die at resin molding, and a resin is filled into a cavity of the mold die so that a package portion is formed. A dotted line in the figure schematically shows the package portion P formed integrally by the resin molding. The support portion 5c has two separated end portions inside the resin package portion P so as to support the respective substrate portions 5a and the lead pins 5d to the frame portion 5b. The separated end portions are combined into one body outside the package portion P to be connected to the frame portion 5b. Accordingly, the substrate portions 5a are sufficiently fixed to the frame portion 5b and the substrate portions are sufficiently insulated from each other by cutting the separated end portions after the resin molding.

When the above lead frame is used to form a multi-core optical module, electronic circuit elements are mounted on the substrate portions 5a and are connected to the lead pins 5d and to optical operation elements fixed to optical connectors. Then the lead frame is subjected to the resin molding to form the multi-core optical module.

FIG. 4 shows a second embodiment of the present invention. The second embodiment is equivalent to the first embodiment except that the support portion 5c has a stress absorbing portion 5f which is a thin zigzag portion provided in the support portion 5c.

The stress absorbing portion 5f will readily deform under applied stress. Thus, even if the support portion 5c becomes shorter due to the contraction of resin after resin molding, the stress absorbing portion 5f will stretch to compensate, relieving the frame portion 5b from undesired stress. Since the frame portion 5b is no longer pushed, the lead pins 5d are no longer forced out of the inside of the formed resin. There is no clearance at the interface between the lead pins 5d and the formed resin portion, and consequently, humidity resistance and pull-out strength of the lead pins 5d are not diminished. Because no substantial stress is applied to the inner portion of the lead pins, wires bonded to the lead pin 5d are safe from breaking. Further, when unnecessary portions of the lead frame in a final product are cut off by a stamping die, it is possible to cut the portions at an accurate position, because there is no deformation of the frame portion caused by the undesired stress.

FIG. 5 shows a third embodiment of the present invention. This embodiment is equivalent to the second embodimet except that stress absorbing portions 15f are disposed on a frame portion 5b. In this embodiment, when the support portion 5c becomes shorter due to the contraction of resin after resin molding, the stress absorbing portions 15f will contract to compensate, releiving the frame portion 5b from undesired stress.

FIG. 6 shows a lead frame according to the fourth embodiment of the present invention. This embodiment is equivalent to the third embodiment shown in FIG. 5 except that the separated support portion is combined into one body at the frame portion. This embodiment has also the same effects as those in the second embodiment. In this case, a resin may enter into portion A between the separated portions of support portion at the molding step, so that burrs are formed. However, this burrs can be removed at a subsequent step.

FIG. 7 shows a lead frame according to the fifth embodiment of the present invention. This embodiment is equivalent to the second embodiment shown in FIG. 4 except that three substrate portions 5a and two support portions 5c are provided. This embodiment has also the same effects as those in the former embodiments. That is, the present invention is also applicable to a multi-core optical module having more than three cores.

It will be readily apparent to those skilled in the art that other embodiments of the present invention may be implemented without departing from the scope of inventive concept expressed by the following claims.

Claims

1. A lead frame, comprising:

   a frame portion;

   a plurality of substrate portions on which electronic circuit elements are to be mounted; and

   at least one support portion for supporting said plurality of substrate portions to said frame portion, said support portion having a plurality of separated end portions connected to said respective substrate portions and at least two of said plurality of end portions being combined into one body to be connected to said frame portion.

2. A lead frame as claimed in claim 1, wherein a stress absorbing portion is disposed in said support portion.

3. A lead frame as claimed in claim 1, wherein at least one stress absorbing portion is disposed in said frame portion.

4. A lead frame as claimed in claim 1, wherein said lead frame is used as a component for producing a multi-core optical module including a plurality of optical connectors fixing optical operation elements and electronic circuit elements connected to said optical operation elements.

FIG. 1
PRIOR ART

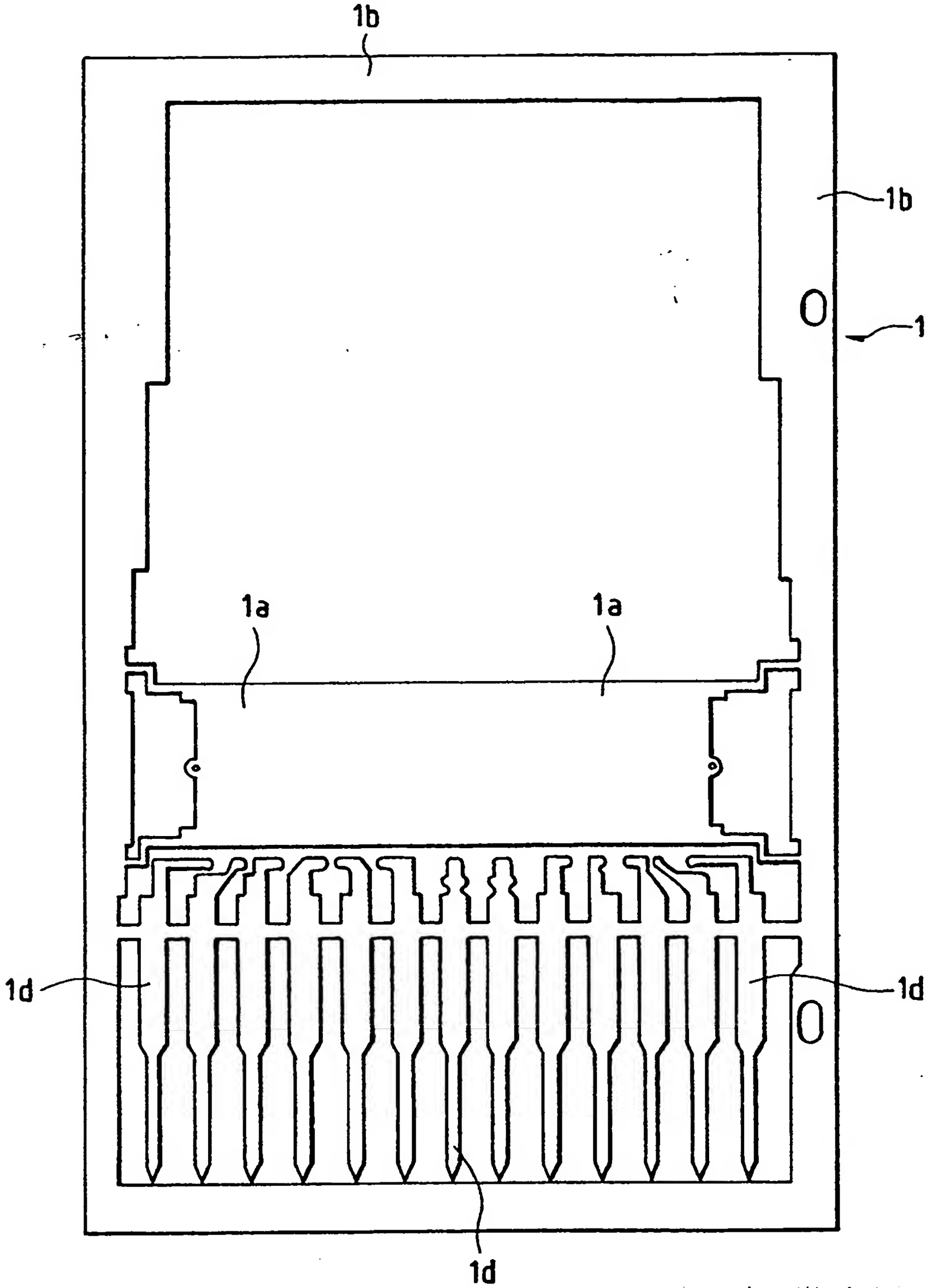


FIG. 2
PRIOR ART

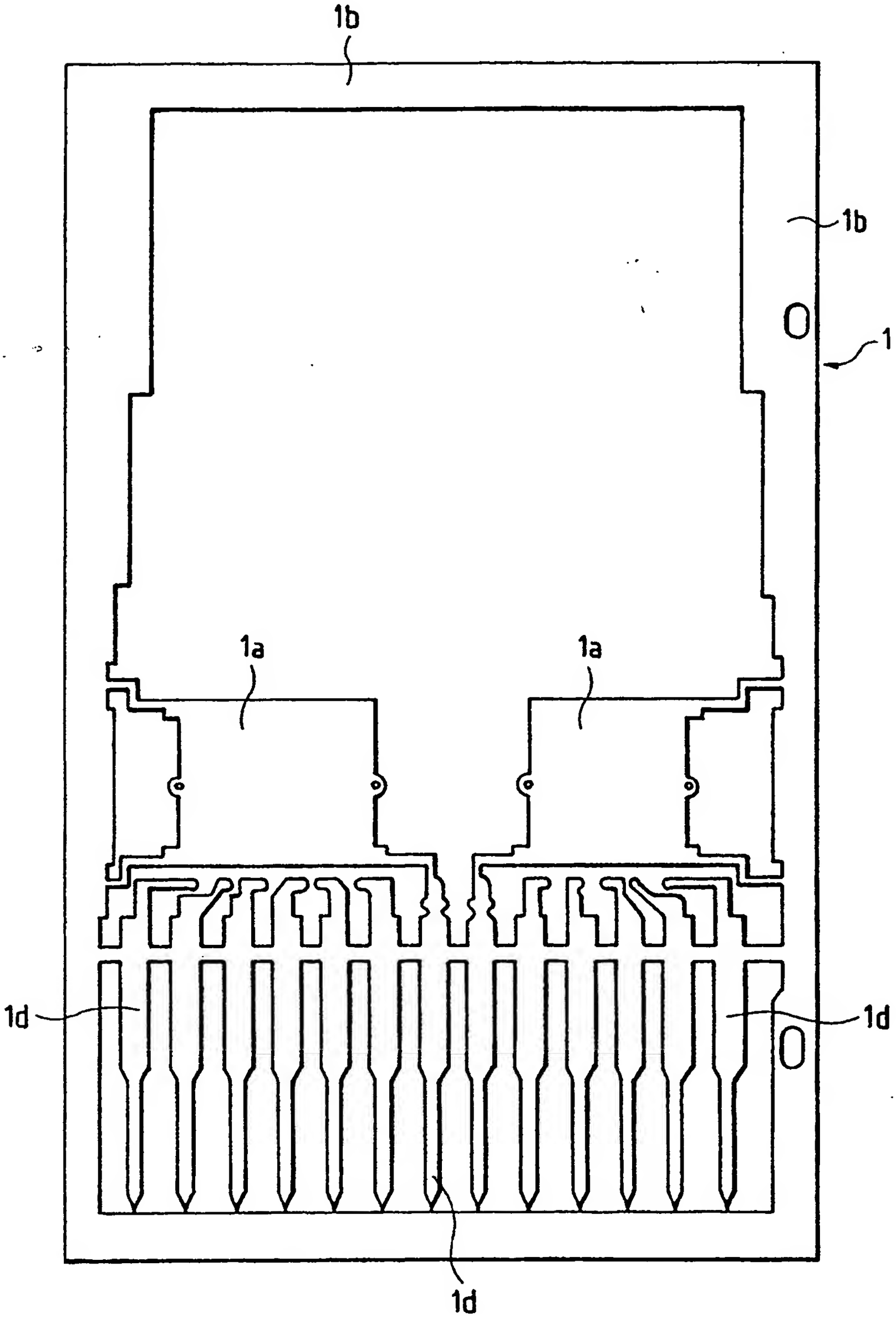


FIG. 3

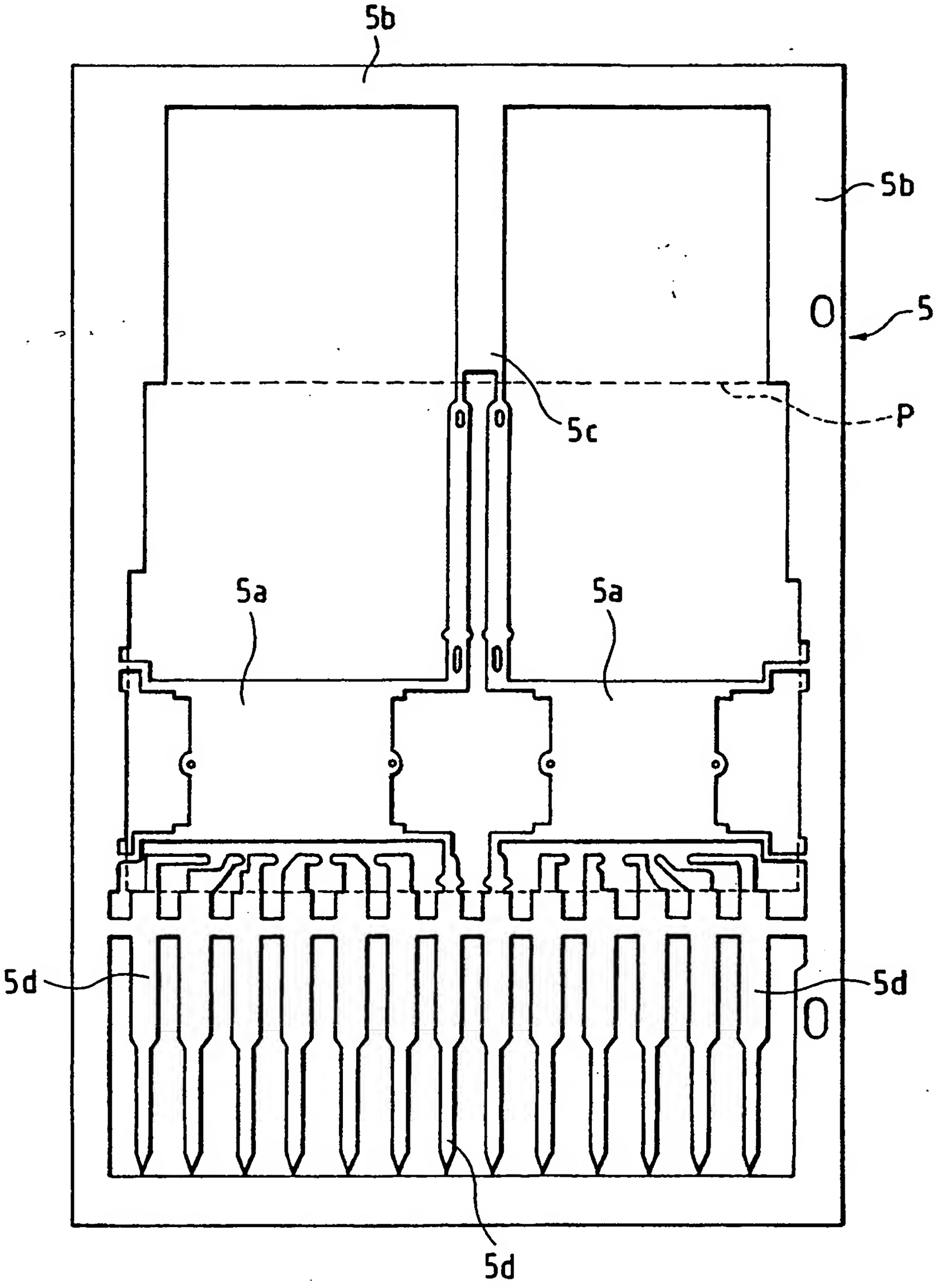


FIG. 4

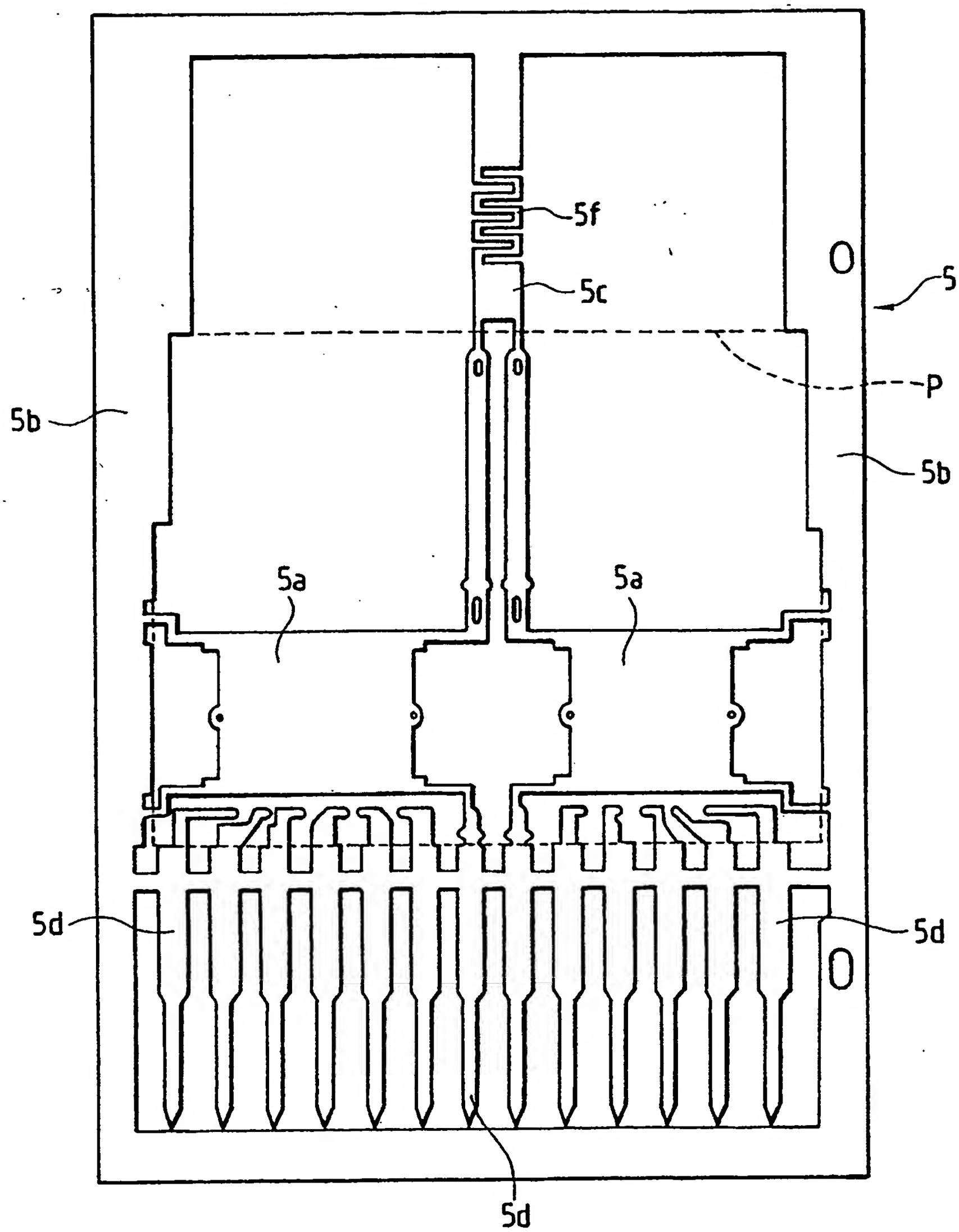


FIG. 5

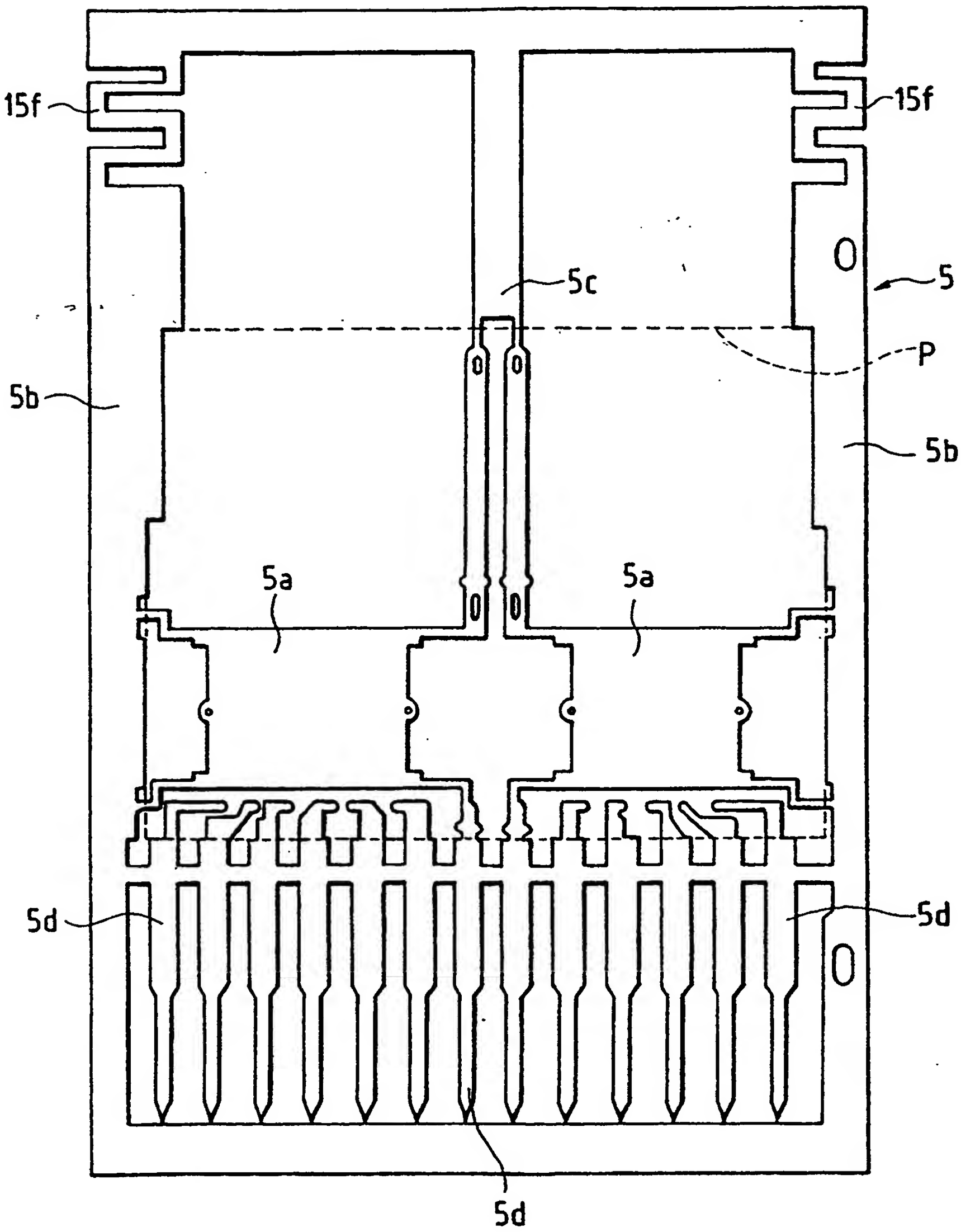


FIG. 6

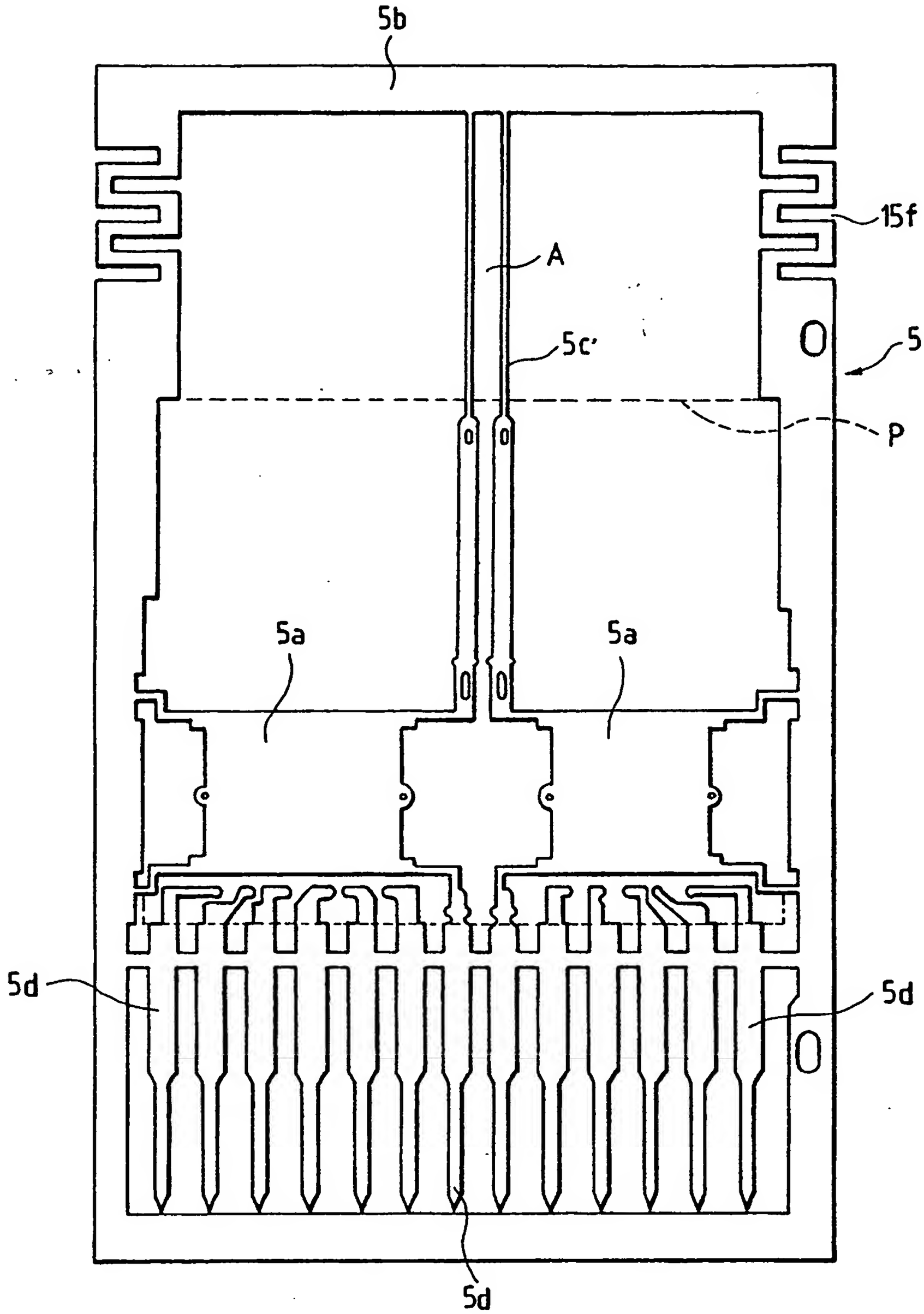
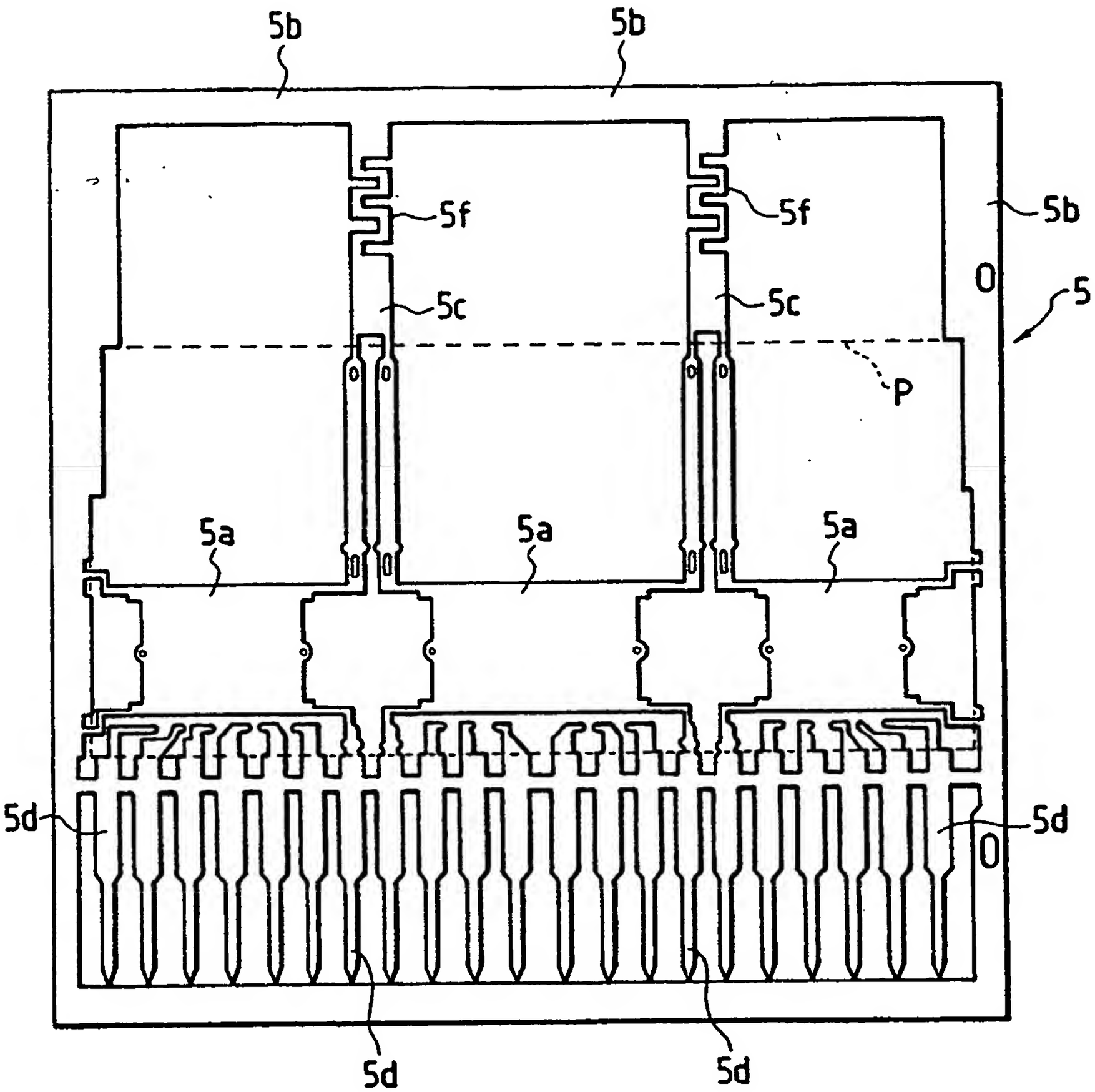


FIG. 7



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EUROPEAN SEARCH REPORT

Application Number

EP 91 10 2764

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	PATENT ABSTRACTS OF JAPAN vol. 012, no. 009 (E-572) 12 January 1988, & JP-A-62 169334 (HITACHI LTD.) 25 July 1987, * the whole document *	1,2	H 01 L 23/495
Y,A	PATENT ABSTRACTS OF JAPAN vol. 009, no. 133 (P-362) 08 June 1985, & JP-A-60 017411 (SUMITOMO DENKI KOGYO KK.) 29 January 1985, * the whole document *	1,2,4	
A	PATENT ABSTRACTS OF JAPAN vol. 012, no. 221 (E-625) 23 June 1988, & JP-A-63 015454 (FUJITSU LTD.) 22 January 1988, * the whole document *	1,2	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

H 01 L

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	17 June 91	ZEISLER P.W.

CATEGORY OF CITED DOCUMENTS

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